

1041.C1

Industrial Exposure and Control Technologies for OSHA Regulated Hazardous Substances



U.S. Department of Labor
Elizabeth Dole, Secretary
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Volume I of II
Substances A-I

Occupational Safety and Health Administration
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Beryllium and compounds
(CAS NUMBER: 7440-41-7)

SYNONYMS

Glucinium/Beryllium oxide/Beryllium salts

TRADE NAMES

NONE

DESCRIPTION OF SUBSTANCE

Beryllium is a hard, brittle, gray-white metal. It is soluble in alkalis and acids, except nitric acid. [ACGIH, P. 56, 1986]
It is resistant to oxidation at ordinary temperatures.

HEALTH EFFECTS

The ACGIH classifies beryllium as an A2 suspected human carcinogen; NIOSH considers beryllium to be carcinogenic. Beryllium and its compounds, under different conditions of exposure to dust or fume, produce a variety of serious effects in animals and humans. Exposure to the highly soluble salts causes conjunctivitis, nasopharyngitis, tracheobronchitis, and pneumonitis. Exposure to powders containing finely divided beryllium oxide has produced delayed-onset pulmonary granulomatosis and hepatomegaly among fluorescent tube workers. Skin exposure has resulted in contact dermatitis. Beryllium metal or compounds implanted in lacerations may result in skin ulcers and granulomas. [PROCTOR AND HUGHES, P. 123, 1978]
The attack rate for acute pneumonitis in an ore-reduction operation with higher exposures was greater than 10% in 1950, versus 3% in all employees. Symptoms from a frank exposure may appear in a few hours, and recovery in from 1 to 12 weeks, rarely with any residual effects. The typical signs of chemical pneumonitis appear as anorexia, weight loss, weakness and varying degrees of cyanosis. The physical signs include lowered vital capacity, fine to coarse sibilant rales, and rapid pulse. X-ray findings are usually a peribronchial haziness and punctate infiltration throughout the lower lung fields or, in severe cases, consolidation. [PATTY. INDUS HYG & TOX 3RD ED VOL2A,2B,2C 1981-82]
Fumes of beryllium in refining or manufacturing produce metal fume fever, coryza, bronchitis. [THIENES. CLIN TOX 5TH ED 1972]
Death may result from short exposure to very low concentrations of the element and its salts. Contact dermatitis, chemical conjunctivitis, corneal burns, non-healing ulceration at site of injury, and subcutaneous nodules may occur following exposure. Pneumonitis may result from single exposure to beryllium and occasionally is fatal. [MERCK INDEX. 10TH ED 1983]
Pulmonary granulomatous disease may appear in 3 months to 15

years, often after short exposure to low concentrations. There is uncertainty as to complete recovery. Death rate is about 25%. [MERCK INDEX. 10TH ED 1983]

Beryllium intoxication shows pathologic involvement of skin, kidney, and lymph nodes. There may be abnormal biochemical indices in serum protein changes, urinary calcium level, dye retention in liver and nitrogen balance. [CASARETT. TOXICOLOGY 1975]

In 20 cases of acute illness which were followed up for 12 years, one pulmonary fibrosis with decreased vital capacity was observed. [IARC MONOGRAPHS. 1972-PRESENT]

Three distinct types of skin lesions have been seen: dermatitis, ulcerations, and granulomas. [CASARETT & DOULL'S TOXICOLOGY. 2ND ED 1980]

Chronic toxicity caused by airborne dust of beryllium, in some cases one year after chronic inhalation exposure, include heart enlargement and congestive heart failure; enlargement of liver and spleen; cellular infiltration in interstices of various organs and tissues, and calcific inclusions in cells and tissues. [VENUGOPAL. METAL TOX IN MAMMALS 2 1978]

In men exposed to beryllium on the job (less than 8 mg/m³, 4-6 hours day), beryllium concentrated in blood and urine showed a mean increase of a factor of 4 over control subjects.

Beryllium-specific stimulation of thymus-derived lymphocytes of the exposed men was increased significantly. [STIEFEL T ET AL; TOXICOKINETIC AND TOXICODYNAMIC STUDIES OF BERYLLIUM; ARCH TOXICOL 45(2) 81 (1980)]

TOXICITY/EXPOSURE LIMITS

NFPA RATING - Flammability - 1 Slight
Health - 4 Extreme
Reactivity - 0 None

TOXICITY HAZARD RATING - Acute and chronic local: skin 3; mucous membranes 3; eyes 3. Acute and chronic systemic; ingestion 3; inhalation 3; skin 3. 3=High: may cause death or permanent injury after exposure to small quantities. [SAX. DANGER PROPS INDUS MATER 6TH ED, P. 421, 1984]

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH - NONE

OSHA PEL - ***** ppm, 0.002 mg/m³;TWA
***** ppm, 0.005 mg/m³;STEL - 30 minutes
***** ppm, 0.025 mg/m³;Ceiling

ADOPTED ACGIH/TLV - ***** ppm, 0.002 mg/m³;TWA
A2 - Suspected human carcinogen

NIOSH/REL - ***** ppm, 0.005 mg/m³;TWA
(not to be exceeded) - Human carcinogen

INDUSTRY USE DATA

Beryllium and its compounds are used for hardening of copper; in the manufacture of nonsparking alloy for tools; manufacture of lightweight alloys. [CASARETT. TOXICOLOGY 1975]
Aircraft brakes; electrical relays; space optics; space vehicle re-entry cones. [FRIBERG. HDBK TOX OF METALS 1979]
Component of alloys-e.g., with copper, window material for x-ray tubes; neutron moderator in nuclear weapons and test reactors; heat sink material in aircraft brakes; material in manufacture of aerospace systems; material in manufacturing of mirrors used in space optics; meteorite and heat shielding material for spacecraft; solid rocket fuel. [SRI]

NIOSH 1982 NATIONAL OCCUPATIONAL EXPOSURE SURVEY

SIC CODE	INDUSTRY NAME	TOTAL ON PAYROLL	TOTAL EXPOSED	PERCENT EXPOSED
3544	SPEC. DIES/TOOLS/JIGS FIXTUR.	1,077	58	5.39

NIOSH 1972 NATIONAL OCCUPATIONAL HAZARD SURVEY

NONE

OSHA/EXPOSURE DATA

NONE

ENGINEERING CONTROLS

General ventilation; local exhaust ventilation; hood; enclosure of process or worker, as needed.

PERSONAL PROTECTIVE EQUIPMENT

Clean work clothes daily; gloves; eye protection. [CHRIS. HAZARD CHEM DATA MANUAL. 2 1978]

Respiratory protection should be as follows: At any detectable concentration: any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode or any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus and operated in pressure-demand or other positive pressure mode. Escape: any air-purifying full facepiece respirator with a high-efficiency particulate filter or any appropriate escape-type self-contained breathing apparatus. [NIOSH: POCKET GUIDE TO CHEMICAL HAZARDS P. 59 (1987) DHEW (NIOSH) PUB NO. 85-114]

STORAGE

Protect containers against physical damage. Keep dry and isolate from acids, caustics, and chlorinated hydrocarbons. Separate from oxidizing materials. [NFPA, P. 49-21, 1986]